

is unequivocally arrived at—that the Teleostei embryologically, as also morphologically, are a highly specialized group, and are too far removed from the primitive or protichthyoid type to yield much material for broad generalizations. Attempts in that direction can hardly in any great degree prove fruitful, and must often be misleading. Abbreviation and the intrusion of secondary, and even tertiary, modifications have been so extensive that the conclusions yielded by Teleostean embryology can never have the interest or application which Selachian development possesses. But though the Teleostei, from great specialization, reveal a striking contrast when compared with such a group as the Elasmobranchs, yet investigations into their development, in which our knowledge is so fragmentary, are of great importance from many points of view, and have, it cannot be denied, an eminently practical bearing. The imperfect state of our knowledge regarding the early history and conditions of development of our important food-fishes is happily not likely to exist much longer. That the embryology of these forms is being actively pursued by many investigators is an encouraging and promising sign. Of hardly less importance is the study of those smaller forms upon which the food-fishes are to no small extent dependent for nutriment.

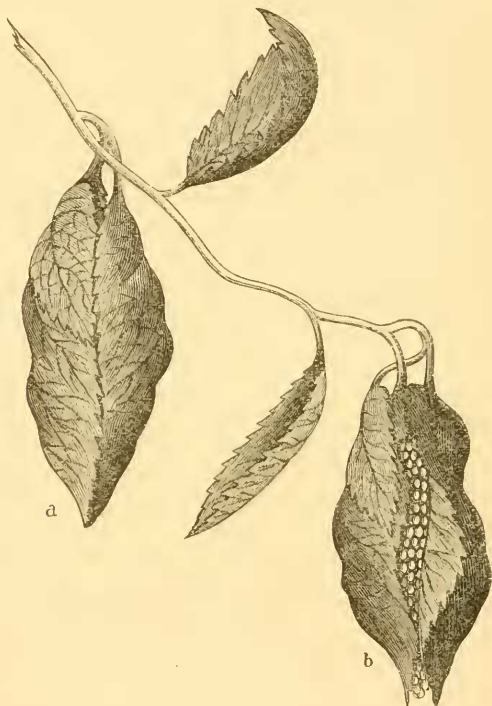
The writer, in conclusion, desires to warmly acknowledge his obligations to Prof. M'Intosh, whose great experience and kind advice are so freely available to those who carry on researches in the Marine Laboratory at St. Andrews. He desires to express his obligations for the use of the scientific section of the University library, for the use of the Caldwell microtome belonging to the University, and for memoirs and accessories in the zoological laboratory at the United College in the University of St. Andrews. Finally, he is under obligations to Prof. Cleland, of Glasgow, and Dr. Hans Gadow, of Cambridge, for suggestions, of which he purposes to avail himself more fully in a later (future) paper, when the preparations, only partially dealt with in this abstract through exigencies of space and time, will be treated more completely.

XLIH.—*On the Oviposition in Phyllomedusa Iheringii.*

By Dr. H. VON IHERING, Rio Grande, Brazil.

UNTIL this year, my attempts to discover the mode of reproduction of *Phyllomedusa Iheringii* had failed. I found the frog in numbers during the breeding-season, but could detect no spawn in the water near which they congregated. I have

now been fortunate enough to elucidate this mystery. *Phyllo-medusa* does not lay its eggs in the water, although the larva develops in that element, but in the open air, in masses 40-50 millim. long by 15-20 broad, between leaves hanging over the water. Willows are frequently used for that purpose. The egg-mass contains rather large white ova, wrapped up between two or three leaves, in such a way as to be completely enveloped save an inferior opening. My attempts at rearing the eggs failed owing to the leaves drying up; but I am assured that the tailed larvæ may be seen wriggling in the gelatinous mass. As at a later period the latter is found empty, we must infer that the larvæ drop into the water below. The eggs are found only on plants hanging over stagnant



A branch with two egg-masses (*a*, *b*) enveloped in leaves.
Natural size.

water. The adult animal is a stupid creature, and will let itself be taken without attempting to escape. Their moderately loud voice resembles somewhat the sound produced by running the finger-nail along a thick hair-comb.

Only during the breeding-season (January) do these frogs

make their appearance; at other times not one is to be seen, probably because they establish themselves high up in the trees. Being otherwise engaged, I have not been able this year to follow out the development of *Phyllomedusa*, but hope to do so next season.

This mode of oviposition appears to constitute a passage to that known in *Hylodes*; the development in the latter, however, is entirely atmospheric, and only partly so in *Phyllomedusa*. A similar mode of protecting the earlier stage of life is known to me in a Dipterous insect, probably *Stratiomys*, the egg-masses of which are also attached to leaves overhanging the water; but it is probably as yet unknown among Vertebrates.

Remarks in Connexion with the preceding Note.

By G. A. BOULENGER.

In regard to Dr. v. Ihering's highly interesting communication, I beg to remark that the fact observed is not new among frogs. Another arboreal form *par excellence*, *Chiromantis rufescens*, Gthr. (= *C. guineensis*, Buchh. & Ptrs.), from West Africa, belonging to the family Ranidæ, thus widely remote from the Hyloid genus *Phyllomedusa*, deposits its eggs in a similar way, as we know from a note published by Buchholz. This observer, when collecting in Cameroon, noticed, in the latter part of June, some large snow-white froth-like masses fixed to the leaves of a low tree hanging over a pool. On examination these masses proved to contain freshly hatched frog-larvæ and eggs, which were later identified as those of the above-named *Chiromantis*. He succeeded in rearing the embryos, which developed a powerful tail, external gills, &c., as in the common frog. The froth-like surrounding does not afford nourishment for more than three or four days to the larvæ, which are then dropped into the water, perhaps with the assistance of rain. The egg-mass is sometimes deposited at a height of 10 feet above the water, frequently attached to several leaves stuck together.

I have endeavoured to bring together in a synoptic table the precise facts actually known respecting the mode in which tailless Batrachians deposit or protect their offspring, and I have added a few references for the use of those who may wish for fuller particulars.

I. The ovum is small and the larva leaves it in a comparatively early embryonic condition.

A. The ova are laid in the water.

Probably the majority of Batrachians; all European forms except *Alytes*.

B. The ova are deposited out of the water.

a. In holes on the banks of pools, which become filled with water after heavy rain, thus liberating the larvæ.

Leptodactylus ocellatus, L.; *L. mystacinus*, Burm.; *Paludicola gracilis*, Blgr.*

b. On leaves above the water, the larvæ dropping down when leaving the egg.

Chiromantis rufescens, Gthr.†; *Phyllomedusa Iheringii*, Blgr.

II. The yolk-sac is very large, and the young undergoes the whole or part of the metamorphosis within the egg; at any rate the larva does not assume an independent existence until after the loss of the external gills.

A. The ova are deposited in damp situations or on leaves, and the embryo leaves the egg in the perfect air-breathing form.

Rana opisthodon, Blgr.‡; *Hylodes martinicensis*, D. & B.§

B. The ova are carried by the parent.

a. By the male.

a. Round the legs; the young leaves the egg in the tadpole state.

Alytes ||.

β. In a gular (the vocal) sac; the young is expelled in the perfect state.

Rhinoderma ¶.

b. By the female.

a. Attached to the belly.

Rhacophorus reticulatus, Gthr.**

β. Attached to the back; the young completes its metamorphosis within the egg.

Pipa ††.

γ. In a dorsal pouch.

aa. The young leaves the pouch in the tadpole state.

Nototrema marsupiatum, D. & B.††

bb. The young leaves the pouch in the perfect state.

Nototrema testudineum, Esp.††; *N. oviferum*, Weinl.§§

* Hensel, Arch. f. Naturg. 1867, pp. 124, 129, 138.

† Buchholz, Mon. Berl. Ac. 1875, p. 204, and 1876, p. 714, pl. ii.

‡ Boulenger, Trans. Zool. Soc. xii. 1886, p. 51.

§ Bello y Espinosa, Zool. Gart. 1871, p. 351; Bavay, Ann. Sc. Nat. (5) xvii. 1873, art. 16; Peters and Gundlach, Mon. Berl. Ac. 1876, p. 709.

|| Demours, Mém. Acad. Sc. Paris, 1741, p. 13; De l'Isle du Dré-neuf, Ann. Sc. Nat. (6) iii. 1876, art. 7.

¶ Jimenez de la Espada, An. Soc. Esp. Hist. Nat. i. 1872, p. 139; Spengel, Zeitschr. wiss. Zool. xxix. 1877, p. 495.

** Günther, Ann. & Mag. Nat. Hist. (4) xvii. 1876, p. 379; Ferguson, *op. cit.* xviii. 1876, p. 357.

†† Fermin, Développement parfait du mystère de la génération du fameux Crapaud de Surinam: Maestricht, 1765.

‡‡ Boulenger, Cat. Batr. Ecaud. 1882, p. 417.

§§ Weinland, Arch. f. Anat. Physiol. 1854, p. 449.